Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

NOTES ON THE ANATOMY AND CLASSIFICATION OF THE GENERA OMPHALINA AND MESOMPHIX.

BY HENRY A. PILSBRY.

In the course of studies on the shells of large *Zonitidæ* of the Southern States Mr. George H. Clapp reached the conclusion that the species referred to *Omphalina* are divisible into two generic groups, one having the embryonic whorls of the shell smooth, the other having these whorls radially costulate or sharply striate. His results being communicated to me, an anatomical study of all the species was undertaken. I found that two genera are clearly indicated by the soft anatomy and that these coincide with the groups based upon the sculpture of the embryonic shells, except that the species *inornata* Say and *andrewsæ* Pils. have smooth embryos, yet their soft anatomy is like the group with striate embryos.

Hoping to find time for a revision of the species with full illustration of the shells, I laid aside the notes made in 1905–6; but as opportunity for the preparation of adequate illustrations of the shells has not appeared, the anatomical and taxonomic data are now published.

W. G. Binney, in the *Terrestrial Mollusks*, vol. V, has figured the genitalia of *inornata* (Pl. XI, fig. C), *friabilis* (fig. D.) and *lævigata* (fig. E). In the latter figure the penis is lettered *d.s.*, and its flagelliform gland and retractor, or both, marked *r. Omphalina friabilis* is figured with a vaginal gland marked *p.p.* The fact is that Binney took the distal end of the penis for an appendage or dart-sack, and did not recognize the true nature of the epiphallus. The resulting inaccuracy of the figures and descriptions deprives them of value. He has, however, done much useful work on the dentition, the shell-characters, and in the elucidation of the older species, the synonymy of which had become intricate.

Genus **OMPHALINA** Rafinesque.

It is proposed to restrict this genus to species having the embryonic whorls of the shell smooth, and the penial retractor muscle terminal on the penis, which does not extend beyond it in a flagelliform blind sac. The type is *O. cuprea* Rafinesque (*fuliginosa* "Griffith" Binney).

The Mexican species *lucubrata* Say (Pl. XXXVII, fig. 8, genitalia), *caduca* Pfr., *zonites* Pfr., belong to this genus. *Zonyalina* (*jalapensis*) and *Patulopsis* (*carinata*), according to Strebel's figures, are very closely related and might be retained as subgenera of *Omphalina*, as von Martens has done.

Both *Omphalina* and *Mesomphix* have a collar-like gland, usually chocolate-colored, around the base of the vagina. A similar gland has been noticed in *Zonites algirus*, *Zonitoides nitida* and *excavata*, *Rhysota brookei*, etc. Its apparent absence in some dissections may be due to imperfect preparation or to imperfect development or pigmentation. The external features of the soft parts are similar in the two genera. In both the orifice of the genitalia is posterior, under the pneumostome, as shown in fig. 2 C.

The dentition is not greatly varied in the Omphalinas of the United States and probably the radulæ of *O. pilsbryi*, *O. cuprea* and *O. friabilis* could not always be distinguished. *O. kopnodes* has more lateral teeth than the other species. The number of teeth in radulæ counted is as follows:

	Central.	Lateral.	Marginal.	
O. kopnodes	1	7	66	Huntsville, Ala.
"	1	9	57	(Binney).
O. pilsbryi	1	5 or 6	49 or 50	Wetumpka, Ala.
O. cuprea	1	5	54	Emporium, Pa.
"	1	5	45	Pennsylvania.
"	1	4	60	(Binney).
O. c. ozarkensis	1	6	54	Magazine Mt., Ark.
O. friabilis	1	7	54	Wyandotte, I. T. (*immature*).
"	1	5	65	San Marcos, Tex.
"	1	5	55	Mablevale, Ark.
"	1	6	51	(Binney).

The position of the epiphallus on the penis is a character of importance in distinguishing species, but it fails with immature individuals, in which the epiphallus is probably always inserted very near the end of the penis. The "swollen" or "slender" shape of penis and epiphallus is variable individually, and probably related to functional activity. The measurements of the organs in specimens figured follow:

Length of	*kopnodes.*	*cuprea.*	*pilsbryi.*	*friabilis.* (Mablevale.)	*friabilis.* (San Marcos.)
Penis	10.5	12	9	5	6
Epiphallus	21	15.5	16	5.5	15
Vagina	7.5	6		4	8.5
Spermatheca and its duct	19	15	11	8	13.5

A Miocene species, *O. laminarum*, has been described by Professor

Cockerell from the Florissant shale, but the fragment obtained leaves the generic reference in doubt.

Omphalina cuprea Rafinesque.

Helix fuliginosa Griffith, of Binney and other authors.

The tail is flattened, the caudal pore a small slit not reaching the end, as figured for *O. friabilis* from San Marcos. The mantle over the lung has some irregular scattered spots and some of the branches of the vena cava are diffusely pigmented in places. *The pulmonary vein and its branches are not pigmented.* The collar usually has a black patch or several spots. Specimens from many localities examined.

In two examples of *O. c. polita* from Cades Cove I found a few spots near the branches of vena cava and on the collar in one, the other being without pigment spots.

The genitalia of an individual from York Furnace, Pa., have been figured in these PROCEEDINGS for 1894, p. 14, Pl. I, fig. 5.

In other specimens opened the penis and epiphallus are less swollen, but otherwise similar. The base of the vagina is swollen and white, not chocolate-colored, as in the Arkansan form. The retractor muscle of the penis is rather short. The epiphallus arises near the end of the penis, but not quite so near as in *O. kopnodes.*

I have examined several radulæ. One from Emporium, Cameron County, Pa., has 54, 5, 1, 5, 54 teeth (Pl. XXXVIII, fig. 1), the central and laterals with side cutting points. The decrease of the marginals to the outer edge is very gradual, as usual.

Another radula from Pennsylvania has 45, 5, 1, 5, 45 teeth. Binney found 60, 4, 1, 4, 60 teeth in one, 57, 1, 57 in another radula.

The number of teeth and of laterals is variable in different colonies, but apparently neither reaches the number found in *O. kopnodes.* The ectocones are a little better developed than in *O. friabilis,* but it is doubtful whether some radulæ could be distinguished.

Rafinesque's description is as follows: "Omphalina, differs from Helix by no lips, but an umbilic. *O. cuprea,* suboval, four spires, smooth, brittle, diaphanous, coppery, shining, opening very large. In Kentucky." While this definition leaves much to be desired, it is excellent as far as it goes. It will apply to no other Kentucky shell, to my knowledge. The adjective "coppery" is especially good. Binney years ago recognized *cuprea* as identical with *fuliginosa,* but he continued to use the later name, either being opposed to change or perhaps considering Rafinesque an outlaw, undeserving of recognition. This view seems to have been prevalent with the early American conchologists.

Binney states that he never received this species from west of the Mississippi River south of Iowa. I never saw it in Iowa, nor do I know of any record from Iowa, Minnesota or any northern State west of the Mississippi.

Omphalina cuprea ozarkensis P. and F.

Omphalina fuliginosa ozarkensis Pilsbry and Ferriss, Proc. A. N. S. Phila., 1906, p. 562.

Shell similar to that of *O. cuprea*. Soft parts differing by having the branches of the vena cava in the lung intensely black-pigmented, showing through the shell in life. Epiphallus inserted midway on the penis, not distally as it is in *O. cuprea*.

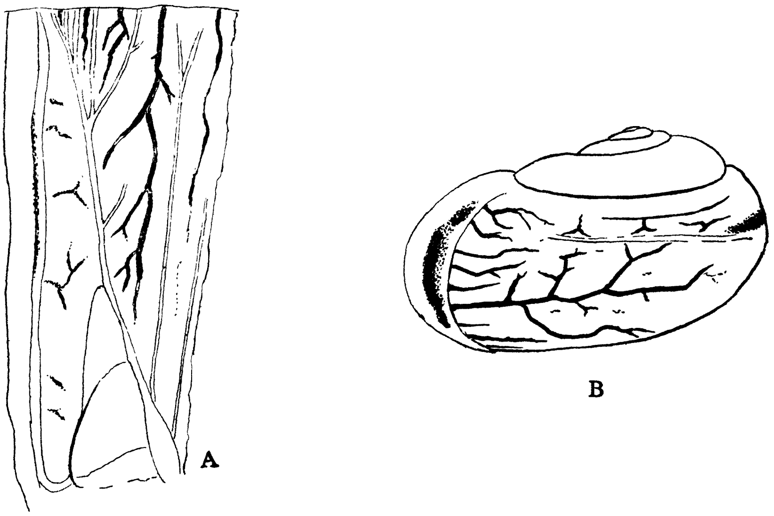


Fig. 1.—*O. cuprea ozarkensis*. A, pallial region of individual from Magazine Mountain. B, the same as seen in an unopened specimen removed from the shell, the pigmented blood vessels showing through the mantle. Petit Jean, Ark.

Petit Jean Mountains, south of Magazine Mountain, Arkansas. Cotypes No. 91,348 A. N. S. P., collected by Ferriss and Pilsbry, April 1 and 2, 1903. Also on the north side of the summit of Magazine Mountain, Logan County, Arkansas, March 28 to April 2, 1903, and Sugarloaf Mountain, on the Oklahoma boundary.

I can find no differential characters in the shells of this race, though the microscopic striation and obscure granulation may be a trifle more distinct than in *cuprea;* but the anatomical characters seem so diverse that a special race is indicated. In the field it was at once recognized by Mr. Ferriss and myself as unlike any *Omphalina* we had seen, on account of the black lines of the lung showing through the shell.

As usual in this genus, it lives on moist, well-shaded hillsides, buried in the leaf-covered humus up to the apex, which alone is exposed.

The external characters of foot and body are substantially as in *O. friabilis* from San Marcos, Texas, except that the last half of the last whorl, as seen through the shell in life, shows a few *irregular, sharply defined black lines* on a pale, or in life cream-white ground.

The pallial tract when opened (fig. 1 A) shows a short subtriangular brown kidney, the ureter projecting well forward from its apex. The secondary ureter is closed throughout. The pulmonary vein branches somewhat freely near its anterior end, and there are two slender, weak branches of the pericardial vein. *All of these veins are colorless,* like the pale wall of the lung. *Most of the branches of the vena cava are intensely black* and show on the outside as black lines. This marking renders the subspecies easy to recognize in the field or when handling alcoholic specimens.

The genital system (Pl. XXXVII, fig. 3) is practically identical with that of *O. friabilis* from San Marcos, Tex., but differs in the following points: the base of the vagina is not swollen, the penis is more slender and the muscle controlling the epiphallus is inserted at the distal third of the latter instead of near its end.

The epiphallus is inserted about midway on the penis, whereas in *O. cuprea* it inserts near the distal end. The organs of the individual drawn measure:

Length of penis	7.5 mm.
" " epiphallus	14 "
" " vagina	6.3 "
" " spermatheca and duct	13 "

Two radulæ examined agree essentially with *O. cuprea.* Formula of teeth about 54, 6, 1, 6, 54.

Two shells measure:

Alt. 15.0, diam. 25 mm.
" 13.3, " 22 "

The jaw is yellow, with truncate ends, the median projection either low or strong.

Omphalina cuprea polita Pils.

Omphalina fuliginosa polita Pils., Nautilus, XII, p. 86, Dec., 1898. Ferriss, Nautilus, XIV, p. 56; Pilsbry, Proc. A. N. S. Phila., 1900, p. 134.

Has not been dissected. It is characteristic of the mountains along the Tennessee—North Carolina boundary.

Omphalina pilsbryi Clapp.

Omphalina pilsbryi Clapp, Nautilus, XVIII, p. 30, July, 1904.

The foot has a wide double margin, the upper groove obsolete near the end of the tail, as usual (fig. 2 C). The tail is elevated, not flat as in *cuprea.* The caudal pore is a short median slit, surrounded by concentric grooves (fig. 2 A).

The mantle-edge bears a very large, right lobe and smaller left, both being *conspicuously larger than in other known Omphalinas.* The lung is irregularly and rather copiously maculate (fig. 2 B, anterior end from the inside).

The penis and epiphallus are very long and there is a thick chocolate-colored vaginal gland around the base of the vagina. Other organs as usual in the genus (Pl. XXXVII, fig. 6).

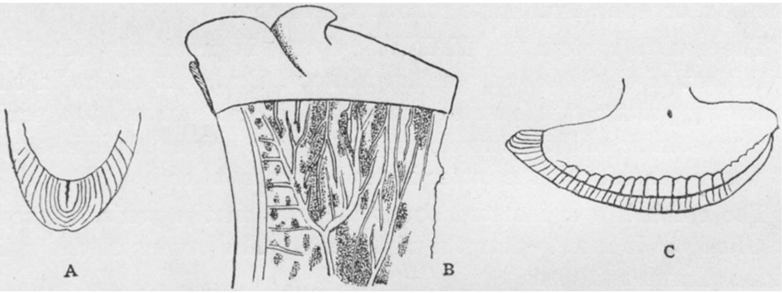


Fig. 2.—*Omphalina pilsbryi* Clapp. A, end of foot and tail pore. B, anterior end of lung and mantle-edge. C, side view of foot, contracted in alcohol, showing position of genital orifice and double foot-groove.

The jaw is pale yellow and has a very strong median projection.

The radula (Pl. XXXVIII, fig. 7) has 55, 1, 55 teeth with 5 or 6 laterals. The basal plates of central and lateral teeth are somewhat shorter than in *O. cuprea,* and the transition teeth have a more distinct and more acute ectocone. Otherwise the teeth do not differ materially from those of *O. cuprea.*

Omphalina kopnodes (W. G. Binn.).

Zonites capnodes W. G. B., Terrestr. Moll., V, p. 98, pl. 2, f. K, teeth. Ann. N. Y. Acad. Sci. I, 357, pl. 14, f. C, genitalia of specimen from near Knoxville, Tenn. Also first supplement to Terr. Moll., V, p. 137.

The foot has the usual double margin. The tail pore is in form of a median slit, with some short converging furrows on each side (fig. 3). The mantle has the same profuse maculation figured for *O. pilsbryi*. The mantle-lobes are not quite so large as in *O. pilsbryi*, but larger than in any other *Omphalina*.

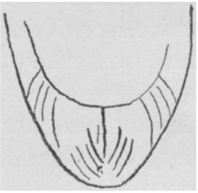


Fig. 3.

In genitalia (Pl. XXXVII, fig. 1), it resembles *O. pilsbryi*, but the proportions of penis and epiphallus differ, and the latter is inserted much nearer to the distal end of the penis than in *O. pilsbryi*, only 1.5 mm. from the end, being more nearly terminal than in any other *Omphalina*. The epiphallus passes without abrupt contraction into the vas deferens. The vagina is enveloped in a large chocolate vaginal gland.

The jaw is pale yellow, with a strong median projection. The radula (Pl. XXXVIII, figs. 3, 5) has 66, 7, 1, 7, 66 teeth. There are distinct outer cutting-points on the central and lateral teeth, the change to the marginal type is very abrupt. A group of marginals from the middle of the marginal field is figured. The teeth decrease in size very gradually towards the outer margin of the radula.

The specimens examined and figured were collected at Monte Sano, near Huntsville, Ala., by Mr. H. H. Smith. The type locality is "Alabama."

Binney found 66, 1, 66 (57, 9, 1, 9, 57) teeth in one, 46, 1, 46 teeth in another radula. I doubt whether the latter radula was from an adult individual. He describes it as with no side cusps, but having cutting-points on the lateral and central teeth, thus agreeing with the radula I examined in the shape of the teeth; but the number of laterals was 9 in his preparation, 7 in mine. The genitalia as figured by Binney agree well with my dissection except in one important particular: he figures the epiphallus as arising near the base of the penis, whereas I found it to spring from near the distal end. The lower part of the epiphallus is bound to the penis, as shown in my figure, and it is probable that Binney did not determine its real point of insertion.

The number of lateral teeth in *O. kopnodes* exceeds that of any others of our species examined except immature *O. friabilis* from Wyandotte, Okla., which has teeth of a quite different shape.

Omphalina friabilis (Binney).

The type locality of this species is banks of the Wabash River and in Illinois. It ranges southwest to San Marcos, Tex., and is a common snail in suitable stations in Arkansas and northeastern Oklahoma, where Ferriss and I collected in 1903.[1] Specimens have been dissected from Mablevale, Ark., Wyandotte, Okla., and San Marcos, Tex. As they show some variation, notes on all are given.

At Mt. Carmel, Ill., the shells are typical. They lack spiral striæ. The Arkansas shells are more depressed and have spiral striation. Moreover, the apices are sometimes slightly worn. In Texas the shells are very globose with spiral striæ and perfect apices.

MABLEVALE, ARK. (Pl. XXXVIII, fig. 4).—The foot has the usual double margination. Caudal pore as in *friabilis* from San Marcos, Tex. The mantle over the lung shows a few irregular scattered small black spots and flecks, and an oblong black spot marking the position of the reflexed ureter, but the veins are not pigmented.

The epiphallus is swollen and not much longer than the penis. The vagina is longer than usual, white to the base, which is not swollen. As the specimen was very hard, from preservation in strong alcohol, it is possible that a vaginal gland was present and much contracted, or possibly torn off in dissection. (Pl. XXXVII, fig. 4.) The jaw is yellow, with truncate ends and a rather low median projection.

WYANDOTTE, OKLA.—Two specimens dissected. In one the radula is normal for *O. friabilis*. In the other, an immature example with a shell 16 mm. in diameter, the radula (Pl. XXXVIII, fig. 2) has about 61, 1, 61 teeth with 7 laterals. Both cusps and basal plates are decidedly shorter than in any other *Omphalina*. The marginal teeth also have remarkably short cusps. All of the teeth are separated more than usual in this genus. The number of lateral teeth is greater than in any other of our species except *O. kopnodes*, which has much longer teeth. The jaw is pale yellow, with a strong median projection.

The epiphallus is almost terminal on the penis, a position which I think must be due to immaturity (Pl. XXXVII, fig. 5).

The pedal grooves are double as usual, caudal pore a simple slit. There is some sparse blackish streaking on the lung (fig. 4).

---

[1] Specimens reported in these PROCEEDINGS for 1906, p. 562, as *O. fuliginosa* from Wyandotte, in the "Wyandotte Nation," Oklahoma, are young *O. friabilis*.

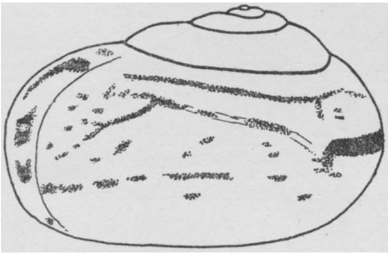


Fig. 4.—*O. friabilis* from Wyandotte, removed from the shell, showing pigmentation of mantle.

San Marcos, Tex.—The pedal lines are double as usual, the deeper ones meeting in a curve over the tail. No distinct caudal mucus pore is discernible in some alcoholic specimens, but the margin is less deeply grooved near the end of the tail than elsewhere. Other individuals have a simple slit. There are no specialized dorsal or facial grooves. The mantle margin has a short right body-lobe, but no shell-lobes. The sole is tripartite. All the veins and arteries of the lung are outlined with black pigment, causing it to appear much darker than the lung of Arkansas examples dissected.

The atrium is excessively short, only reaching through the integument. The penis is stout and short with terminal retractor muscle, inserted distally in the lung floor. About in the middle of the penis a long stout epiphallus enters. It tapers distally into the vas deferens, and near the end receives a very slender muscle which is inserted in the connective tissue around the base of the penis. The vagina is chocolate colored and much swollen below. The spermatheca is very large, oblong, on a slender duct about as long as the vagina (Pl. XXXVII, fig. 2). The organs measure as follows:

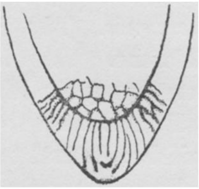


Fig. 5. — *O. friabilis* Binn. from San Marcos, end of foot with tail-pore.

Length of penis	about 6.0 mm.
“ “ epiphallus	about 15.0 “
“ “ vagina	8.5 “
“ “ spermatheca and duct	13.5 “

The jaw is pale yellowish-gray, with a median ridge and strong projection, sides distinctly striate.

The radula of a San Marcos specimen (Pl. XXXVIII, fig. 6) has 65, 5, 1, 5, 65 teeth, the cusps, especially of the centrals, being longer and narrower than in any other of our species of *Omphalina*. Two radulæ examined.

In an individual from Mablevale, Ark. (Pl. XXXVIII, fig. 4), there are about 55, 5, 1, 5, 55 teeth, the centrals somewhat less lengthened. Counted in another place, I found 53, 5, 1, 5, 53 teeth on the same radula.

Binney records 57, 1, 57 teeth with 6 perfect laterals. The locality of the snail he examined was not stated. Except in having somewhat longer cusps, the radulæ I prepared differ very little from *O. cuprea*.

Genus **MESOMPHIX** ('Raf.') Beck.

Beck, Index Molluscorum, p. 7 (1837), for *M. virginalis* B. (undescribed), *M. fuliginosa* Griff., *M. walkeri* Gray, *M. lævigata* Raf., *M. elliptica* Mich. and *M. olivetorum* Gm.

Herrmannsen, Indicis Generum Malacozoorum Primordia, II, p. 40, "typus *Helix lævigata* Raf." (July 17, 1847).

The shell is like *Omphalina*, except that it is more depressed, with a much smaller umbilicus and the embryonic whorls are ribbed or striate radially in most species.

External anatomy as in *Omphalina*. Genitalia differing from *Omphalina* by the development of *a flagelliform gland terminal on the penis*. The epiphallus is distinctly differentiated from the vas deferens. Vaginal gland wanting. Jaw reddish-brown or black, very opaque, with a small median projection.

Radula with the basal-plate of the central tooth contracted in the middle; lateral teeth few, 0 to 4. Marginal teeth as in *Omphalina*.

Type *M. lævigata*.

This genus is well differentiated from *Omphalina* by the presence of a flagelliform penial gland, a very unusual structure in American *Zonitidæ*. This gland is long and slender in *M. subplana* (Pl. XXXVII, fig. 7, *p.g.*), shorter and stout in *M. lævigata* (fig. 10). The shell often bears a diagnostic feature in its scuptured apex. The jaw in all the species examined (*M. lævigata, subplana, rugeli, andrewsæ* and *inornata*) is remarkable for its dark or black color. In *Omphalina* the jaw is pale yellow, so far as observed.

These features are an advance beyond the morphology of *Omphalina*, being, as it were, superposed upon the Omphalinoid organization. The radula also is more specialized by the partial or complete elimination of lateral teeth.

In describing the genus *Mesomphix*, Rafinesque mentioned no species. Its foundation therefore dates from the memorable *Index* of Beck, who included some species of other groups. Herrmannsen, in 1847, expressly selected *lævigata* as the type, probably because this was known to be a Rafinesquian species. Gray, in the same year, names *lævigata* and *olivetorum* as examples. Von Martens and American authors have used the name *Mesomphix* for heterogeneous assemblages of species, but this later usage cannot be upheld against Herrmannsen's selection of *lævigata* as type of the group.

The dentition in *Mesomphix* is varied in the several species. *M. lævigata* is quite peculiar in having no lateral teeth, the inner ones being transitional to the marginal type, and the central tooth is peculiar in the form of the basal plate and the great reduction of its single cusp. The radula in this species is evidently evolving towards the type of *Circinaria.*

In the other species the central tooth is well developed and tricuspid, with a somewhat hour-glass-shaped basal plate. This is least marked in *M. rugeli,* which has teeth much like *Omphalina.* The number of teeth is also characteristic, as seen in the formulas below, in which the transition teeth are counted as marginals.

	Central.	Lateral.	Marginal.
M. inornata	1	2	21–25
M. andrewsæ	1	3	37
M. subplana	1	2	34
M. rugeli	1	4	34–37
M. lævigata	1	0	17–19

Mesomphix may be divided into three subgenera, as follows:

I. Embryonic whorls of the shell radially striate.

Subgenus MESOMPHIX.

No lateral teeth; central tooth with a single small cusp. Flagelliform gland of the penis very short. Type and only species *M. lævigata* "Raf." Beck.

Subgenus MICROMPHIX (new).

Several (two to four) lateral teeth; central tooth well developed, tricuspid. Flagelliform gland of the penis long, about half the length of the penis. Type *M. subplana* Binn. Includes also *M. rugeli.*

II. Embryonic whorls smooth or faintly striate spirally.

Subgenus OMPHIX (new).

Radula and genitalia as in *Micromphix,* but embryonic whorls of the shell smooth. Type *M. inornata.* Includes also *M. andrewsæ* Pils.

Mesomphix lævigata Beck.

> Beck, Index Moll., p. 7, based upon Férussac, Histoire, etc., pl. 82, f. 6.
> *Helix lævigata* Pfr., not of Pennant, 1777. Bland, Ann. Lyc. N. H. of N. Y., VII, p. 120 (identity of *lævigata* with *inornata* Say affirmed).
> *Omphalina lævigata* "Raf." Beck, Pilsbry, Proc. A. N. S. Phila., 1900, p. 134.

Beck gives the locality as North America in South Carolina, but he gave no description, basing the name solely upon Férussac's figures of specimens sent by Rafinesque from Kentucky; hence the type locality is in the latter State.

The common form of *lævigata* from Kentucky south to northern Florida, Alabama, and southwest to Lake Charles, Louisiana, is rather a capacious shell, rarely entirely green, usually russet above, green beneath. The striæ are very fine, close and deeply cut, covered with a beautiful sculpture of minute papillæ in close spiral lines. A large specimen from Alabama measures, alt. 16, diam. 26.5 mm., umbilicus about 1.8 mm. wide.

While there are local differences in size, color, and minute sculpture, it seems doubtful whether any definable races exist except in the southern Alleghanies, where several forms have been differentiated. A very small race occurs in Florida.

Mesomphix lævigata monticola n. subsp.

> *Omphalina lævigata* (specimens from Great Smoky Mountains) Pils., Proc. A. N. S. Phila., 1900, p. 135.

The shell is more glossy on the upper surface than *M. lævigata*, the striæ less deeply cut and less regular, covered with a much more minute, less distinct, microscopic granulation. Smaller than typical *lævigata* and more depressed, green throughout.

Alt. 11.5, diam. 20.5 mm.; $4\frac{3}{4}$ whorls.

Sugar Cove (type locality) and Cades Cove at the western foot of Thunderhead Mountain, and also on Thunderhead nearly to the summit, Blount County, Tennessee, collected by Messrs. Ferriss, Walker, Clapp, Sargent and Pilsbry, 1889. Types No. 71,367 A. N. S. P.

The same form has also been collected by the late Mrs. George W. Andrews, in the same neighborhood, and it was also taken on the Little Tennessee River near Tallassee Ford by Mr. Ferriss.

The so-called *lævigata* from southwestern Pennsylvania is much closer to this race than to typical *lævigata*, and for the present they may be placed here. The shells differ from those of the southern mountains chiefly by being rather strongly chestnut or reddish-brown tinted. Those seen are from Somerset and Fayette Counties, Pennsylvania.

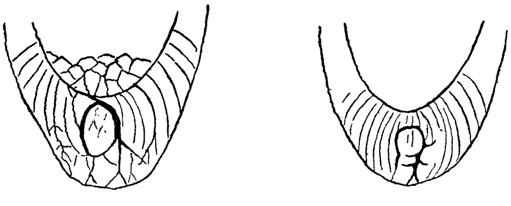


Fig. 6.—*Mesomphix lævigata monticola.* End of foot and tail-pore of two individuals from Cades Cove, Tenn.

The penis is fusiform, slender at its distal end, terminating in a stout finger-shaped gland, and with a very short and strong retractor muscle. Epiphallus somewhat longer than the penis. The lower portion of the oviduct is much convoluted. Vagina short, whitish, not swollen basally, and no vaginal gland was seen (Pl. XXXVII, fig. 10).

Length of penis	8.5 mm.
" " epiphallus	10.0 "
" " vagina	3.0 "
" " spermatheca and duct	10.0 "

The caudal gland is an irregular curved fissure, partly surrounding a median areole (fig. 6).

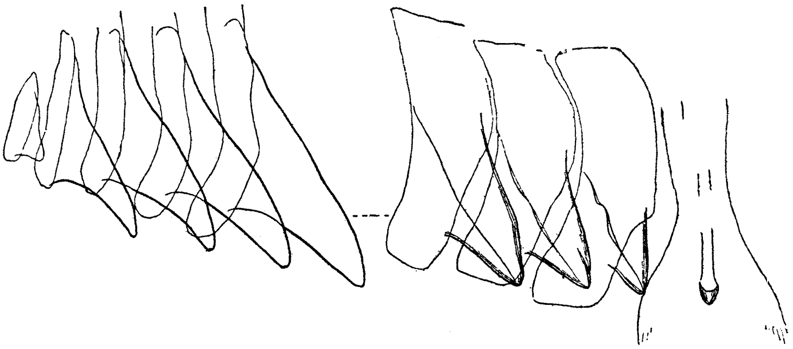


Fig. 7.—Teeth of *M. l. monticola*, Cades Cove, Tenn.

The radula of a specimen from Cades Cove has 19, 1, 19 teeth (fig. 7). The central tooth has a very narrow cusp with a minute cutting point. There is no trace of side cusps. The inner side teeth are "transition teeth," with short, oblique, conic cusps, no ectocones. They are of the aculeate rather than the quadrate form. Further out the cusps are strictly aculeate, but short and stout.

Binney records 19, 1, 19 and 17, 1, 17 teeth in specimens of *lævigata* he examined. His figure shows rudimentary side cusps, but no cutting points on the central, and a well-developed ectocone on the first lateral tooth. The locality of his specimen is not stated.

Mesomphix lævigata perlævis (Pils.).

Omphalina lævigata perlævis Pilsbry, Proc. A. N. S. Phila., 1900, p. 135. Ferriss, Nautilus, XIV, p. 56.

(*a*) The radial striæ on the embryonic 1½ whorls are coarser than in *lævigatus*, weak or wanting on the first half whorl. The typical form from Tallassee Ford, Monroe County, Tenn., has irregular wrinkles on the last whorl, with a spiral sculpture of very faint, close, smooth lines, often nearly or quite obsolete. The largest shell of the type lot measures: alt. 10, diam. 17.5, aperture alt. 9, width 10 mm.; whorls 4½.

A few shells, not quite adult, from Lawrenceburg, Dearborn County, Ind. (A. C. Billups), do not appear to differ from *perlævis*.

(*b*) Three lots from Macon County, Ga., and Black Mountains, N. C., collected by Hemphill, and from Burnside, Ky., collected by Ferriss, differ by having the last whorl closely striate above, but under the microscope only very fine, smooth, spiral lines are seen. A specimen from Macon County measures: alt. 12, diam. 19.5, aperture 9 x 11 mm., with 5 whorls.

(*c*) Another form related to *perlævis* is densely striate above, but the aperture is wider, less rounded. The upper surface is often russet-tinted, as in *M. lævigata*, but the microscopic spirals are faint, fine and smooth, not granulose. The aperture is more oblique than in the preceding race. Alt. 12, diam. 21, aperture 9.3 x 12.7 mm., whorls 5.

This form is from Cheoah River at the junction of Yellow Creek, Graham County, N. C.

Some shells not quite mature, but apparently the same, were taken by Rhoads at Sawyer Spring, Walden's Ridge, Hamilton County, Tenn., at an elevation of about 2,300 feet.

Forms (*b*) and (*c*) may eventually be separated as distinct subspecies.

Mesomphix lævigata latior Pils.

Omphalina lævigata latior Pils., Proc. A. N. S. Phila. 1900, p. 135. Ferriss, Nautilus, XIV, p. 56.

The sculpture of the embryonic 1½ whorls is coarser than in *lævigata;* then 1½ finely striate whorls follow, after which the striæ weaken to low irregular wrinkles. The last 1½ whorls have fine granules in spiral lines, as in the Great Smoky Mountain *monticola.* The soft anatomy has not been examined. It has been found at Tallassee Ford of the Little Tennessee River, Monroe County, Tenn., and at Chambers Creek Church, Swain County, N. C.

Mesomphix (?) perfragilis (Wetherby).

Zonites perfragilis A. G. Wetherby, Notes on American Land Shells, Journ. Cincinnati Soc. Nat. Hist., IV, p. 326, 1881 (undescribed). Same journal for 1894, p. 215.

On principle I oppose the introduction of MS. or "provisional" names into print, because any name not fully defined entails labor and waste of time upon others. Since this name has been printed, it may be well to give what information I can. I quote from a letter received from Wetherby years ago, date not preserved. "I tell you about *Zonites perfragilis* W., MS., so that in case you should go into the limestone region of middle Tennessee you may be on the lookout for it. It is a species built much on the plan of *Z. lævigatus* and varies in size as that does. All the specimens yet found have a shell thinner than that of *Vitrina limpida.* I first found it in a sink-hole in a cedar glade on the Murphreesboro Pike about two miles out of Nashville, in August, 1875. Not doubting my ability to clean them, with care, I plunged them into hot water, but the experiment was fatal. I lost them all. I next put some in alcohol, but before we got back to Cincinnati they were reduced to nothing as to the shells. It is not uncommon, I think, in the limestone sink-holes, especially in the damper parts."

In 1894 Wetherby gave the following description : "As thin and pellucid as *Vitrina limpida,* the shells being extremely fragile and delicate. They were much flattened, and the umbilical opening was much larger than typical *lævigatus.*" Rutherford County, Tenn. This description was from memory, the specimens having been lost as noted above.

In another letter Wetherby reiterates the opinion that *perfragilis* is a very distinct species. It should be easy to find the original locality and to recognize the species from the details given above. They could probably be cleaned successfully if drowned before boiling. Otherwise the forcible retraction of the animal, in shells so fragile, breaks them up.

Mesomphix subplana (Binn.).

The caudal pore resembles that of *Omphalina pilsbryi.*

The penis has a long, slender, flagelliform terminal gland, 5 mm.

in length. Its retractor muscle is long and slender (Pl. XXXVII, fig. 7). Epiphallus 12 mm. long.

The radula examined (Pl. XXXIX, fig. 1) has 36, 1, 36 teeth. The basal-plates are very long, the cusps arising far backward, about the middle of the plates, about as in *M. andrewsæ* and *M. inornatus*. Two or three teeth on each side may be reckoned laterals, having well-developed side cusps and cutting points; the next is transitional, the rest marginals. The marginal teeth are closely crowded, with long slender cusps, longer than in other species of *Mesomphix*, and more like those of some Omphalinas. Binney found 37, 1, 37 teeth in a Roan Mountain specimen, agreeing in form with my figure except that the basal-plates are a little shorter.

The large number, closely crowded and long cusps of the marginal teeth are characteristic of this species.

Mesomphix rugeli (W. G. Binn.).

Zonites rugeli W. G. B., Ann. N. Y. Acad. Sci., I, p. 357, pl. 15, f. H (shell), I (teeth), pl. 14, f. D (genitalia).

Type locality, Roan Mountain, Mitchell County, N. C. The individual I dissected was collected there.

The mantle is unpigmented or of a diffuse smoky color, darker near the collar. The male organs (Pl. XXXVII, fig. 9) do not differ materially from *M. subplana*. Binney's figure shows the epiphallus arising too near the base of the penis, but its real insertion is not far from the middle. Length of penis 8, epiphallus 9.5 mm.

The radula examined (Pl. XXXIX, figs. 2, 3) has 41, 1, 41 teeth, of which about 4 or possibly 5 on each side are laterals, with well-developed cusps and cutting points. The central tooth has a wider, shorter basal-plate than in allied species, more like that of *Omphalina*. The intermediate marginal teeth are rather stout and ungraceful (fig. 3, left side). The outer ones decrease rapidly to the outer edge of the radula (fig. 2). The radula figured has an abnormal row of teeth on one side, the second lateral having a double ectocone. The teeth are all shorter than in *M. subplana*. Binney records 38, 1, 38 teeth, with 4 or 5 laterals, the form of the individual teeth being as figured by me.

This species is quite distinct by the short form of the central teeth and the comparatively large number of lateral and marginal teeth.

Mesomphix rugeli oxycoccus (Vanatta).

Omphalina rugeli oxycoccus Vanatta, Nautilus, XVI, p. 106, January, 1903.

Cranberry and Banners Elk, N. C.

Mesomphix inornata (Say).

Cf. Bland, Ann. Lyc. N. H. of N. Y., VII, 127.

Genitalia as in *M. rugeli*. Caudal pore as in *O. cuprea*.

The radula (Pl. XXXIX, fig. 5) has 24, 1, 24 teeth. The tricuspid centrals have an hour-glass-shaped basal-plate and well-developed cusps. There are two lateral teeth, the next two teeth being transitional. Three side teeth have cutting points on the ectocones. The marginal teeth are less crowded than in *M. subplana* or *M. andrewsæ*, with shorter cusps than the former.

The number of teeth in a row is much smaller in *M. inornata* than in any species except *M. lævigata*. The cusps of the lateral teeth have a bulging outline on the inner side as in *M. andrewsæ*, but they are much longer than in that species.

Mesomphix andrewsæ (Pils.).

The tail pore is like that of *M. lævigata*. The mantle is not pigmented over the lung. The genital system (Pl. XXXVII, fig. 11) differs from related forms by the greater length of the spermatheca duct and epiphallus. The penis is strongly swollen near the base and has a rather long terminal gland (*p.g.*). Its retractor muscle is long. The very short vagina is somewhat swollen near the base, but I can see no vaginal gland there. Length of penis 3.5; of epiphallus 14 mm.; of spermatheca and duct 9.5 mm.

The radula (Pl. XXXIX, fig. 4) has 40, 1, 40 teeth, more crowded than in *M. inornata*, the central and lateral teeth have much shorter, stouter cusps. There are three lateral teeth, the next two being transitional. The marginal teeth are less slender and graceful than in *M. inornata*.

The radula of *M. andrewsæ* most resembles that of *M. inornata*, but differs by the much shorter cusps and the far greater number of teeth.

The soft anatomy of *M. a. montivaga* Pils. has not been examined.

EXPLANATION OF PLATES XXXVII, XXXVIII AND XXXIX.

PLATE XXXVII.—Genitalia of *Omphalina* and *Mesomphix*.

Fig. 1.—*Omphalina kopnodes* (W. G. B.). Monte Sano, near Huntsville, Ala. (H. H. Smith).

Fig. 2.—*Omphalina friabilis* (W. G. B.). San Marcos, Tex. (Pilsbry and Ferriss, 1903).

Fig. 3.—*Omphalina cuprea ozarkensis* P. and F. Magazine Mountain, Ark.

Fig. 4.—*Omphalina friabilis* W. G. B. Mablevale, Ark. No. 81,115 A. N. S. P.

Fig. 5.—*Omphalina friabilis* W. G. B. Immature. Wyandotte, Okla.

Fig. 6.—*Omphalina pilsbryi* Clapp. Near Wetumpka, Ala. No. 87,349 A. N. S. P.

Fig. 7.—*Mesomphix subplana* (Binn.). Thunderhead Mountain. No. 58,004 A. N. S. P.

Fig. 8.—*Omphalina lucubrata* (Say). Texolo, V. C., Mex.

Fig. 9.—*Mesomphix rugeli* (W. G. B.). Roan Mountain, N. C. No. 70,566.

Fig. 10.—*Mesomphix lævigata monticola* Pils. Cades Cove, Blount County, Tenn.

Fig. 11.—*Mesomphix andrewsæ* Pils. Cades Cove, Tenn. No. 76,821 A. N. S. P.

PLATE XXXVIII.—Fig. 1.—*Omphalina cuprea* Raf. Emporium, Cameron County, Pa. No. 68,481 A. N. S. P.

Fig. 2.—*O. friabilis* W. G. B. Wyandotte, I. T. No. 91,353 A. N. S. P.

Figs. 3, 5.—*O. kopnodes* (Binn.). Monte Sano, near Huntsville, Ala.

Fig. 4.—*O. friabilis* (W. G. B.). Mablevale, Ark.

Fig. 6.—*O. friabilis* (W. G. B.). San Marcos, Tex.

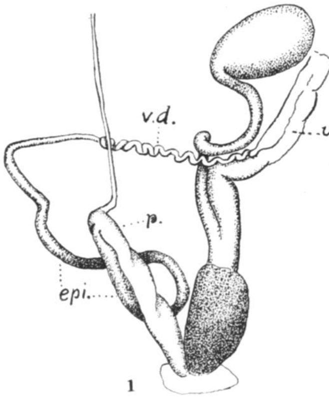
Fig. 7.—*O. pilsbryi* Clapp. Near Wetumpka, Ala.

PLATE XXXIX.—Fig. 1.—*Mesomphix subplana* Binn. Thunderhead Mountain.

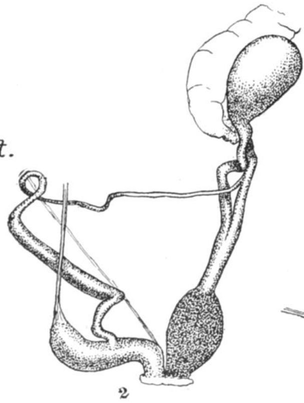
Figs. 2, 3.—*Mesomphix rugeli* W. G. Binney. Roan Mountain, North Carolina.

Fig. 4.—*Mesomphix andrewsæ* Pils. Central, lateral and transitional, and two marginal teeth. Cades Cove, Tenn.

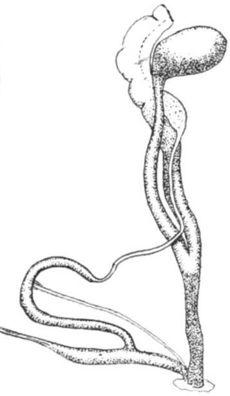
Fig. 5.—*Mesomphix inornata* Say. Pittsburgh, Pa.



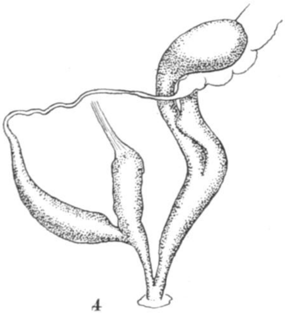
1



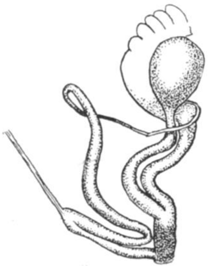
2



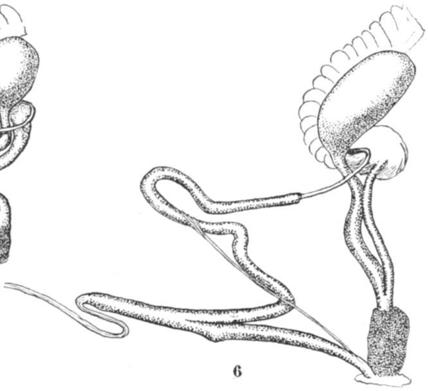
3



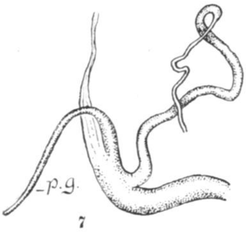
4



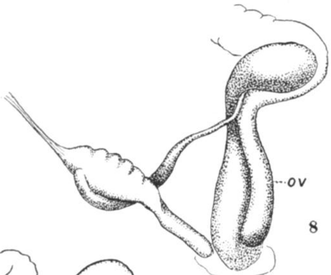
5



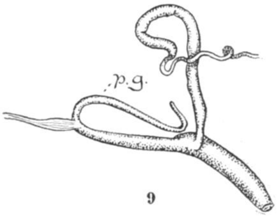
6



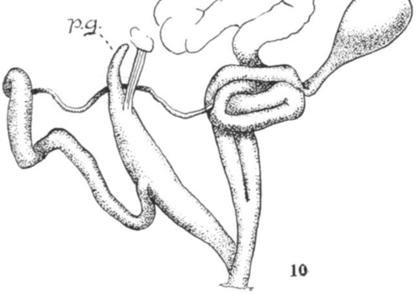
7



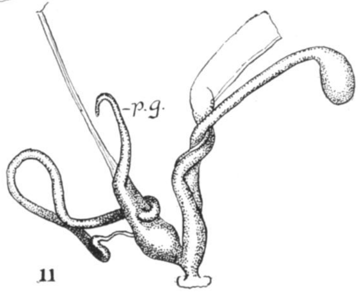
8



9

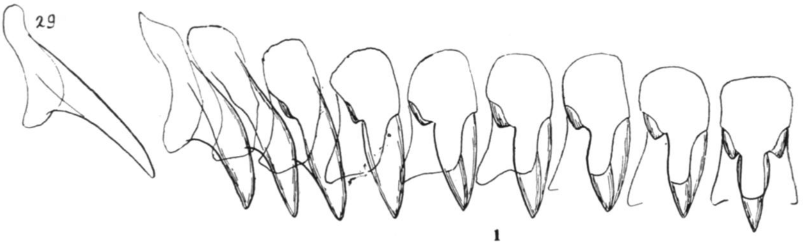


10

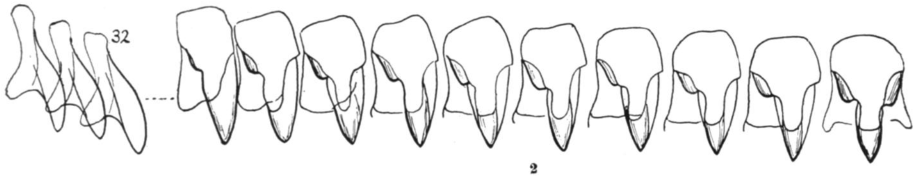


11

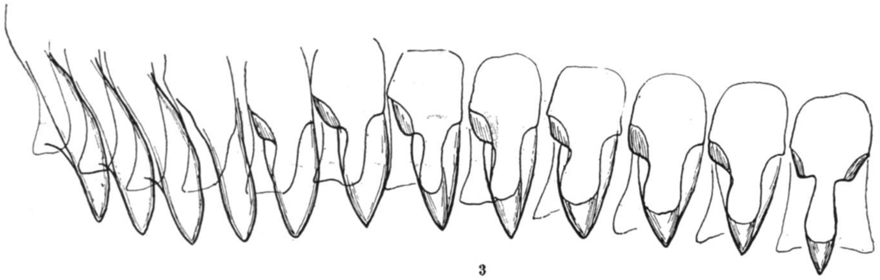
PILSBRY: OMPHALINA AND MESOMPHIX.



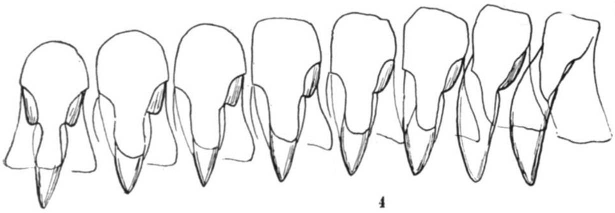
1



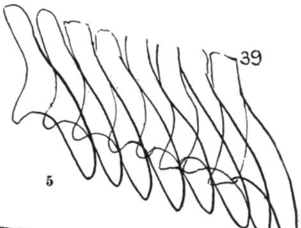
2



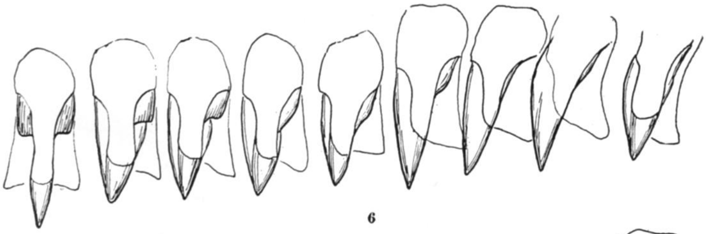
3



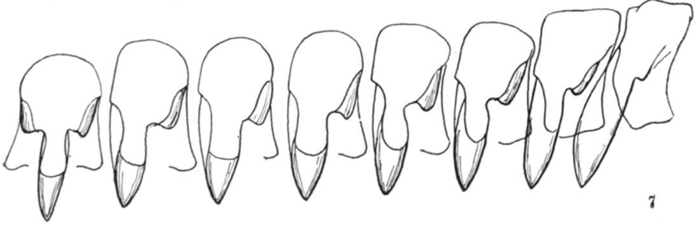
4



5

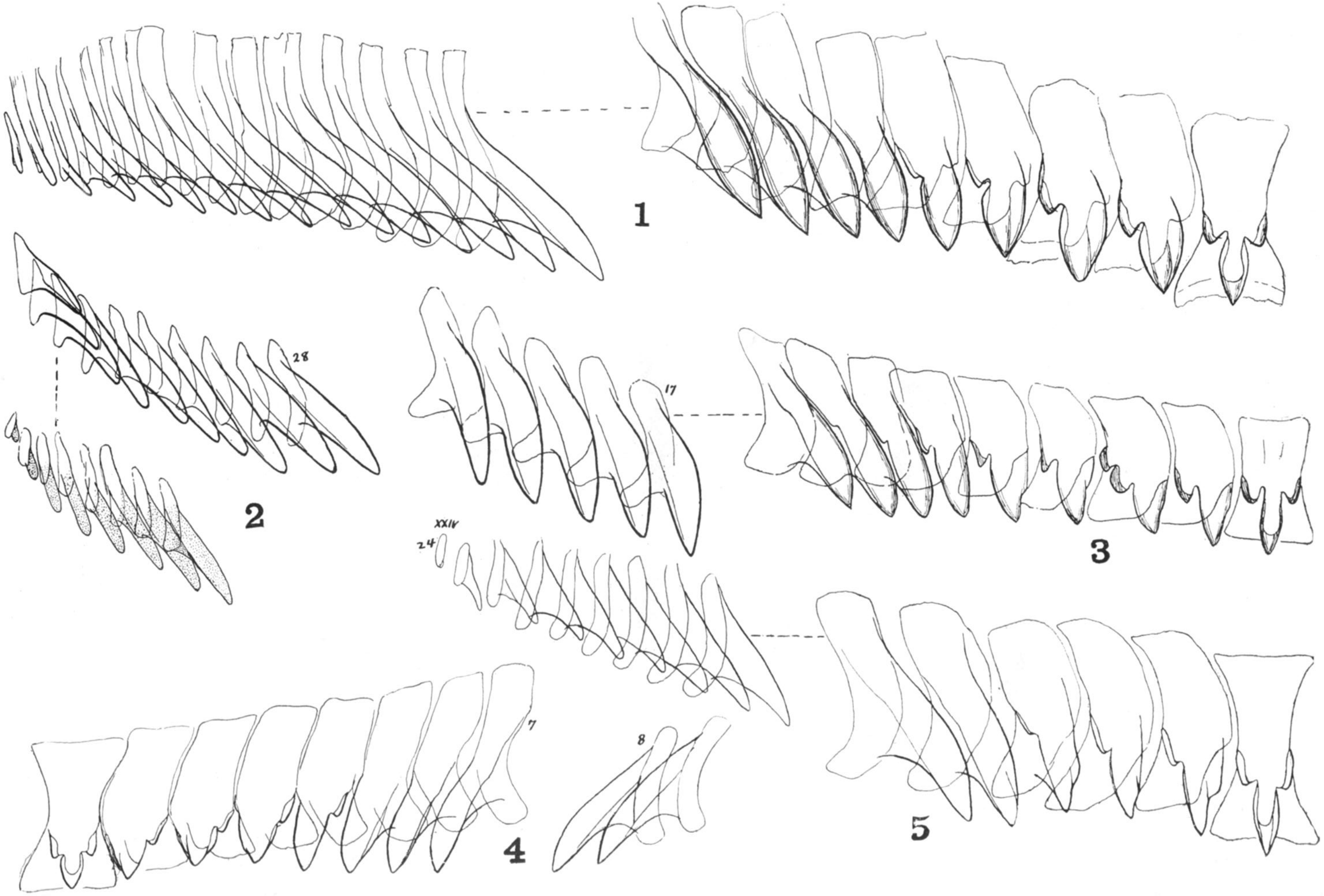


6



7

PILSERY: OMPHALINA AND MESOMPHIX.



PILSBRY: OMPHALINA AND MESOMPHIX.